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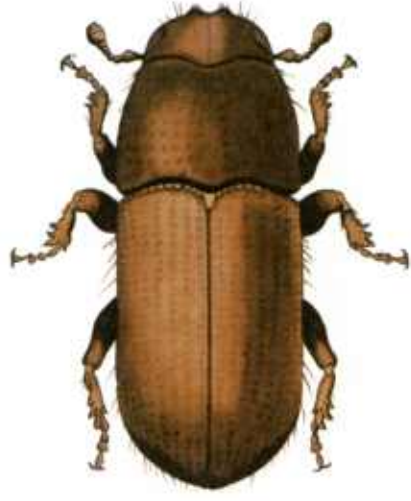
Southern Pine Beetle Handbook

Silviculture Can Reduce Losses from the Southern Pine Beetle



Contents

In 1974, the U.S. Department of Agriculture initiated the Combined Forest Pest Research and Development Program, an interagency effort that concentrated on the Douglas-fir tussock moth in the West, on the southern pine beetle in the South, and on the gypsy moth in the Northeast. The work reported in this publication was funded in whole or in part by the Program. This manual is one in a series on the southern pine beetle.

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Silviculture Can Reduce Losses from the Southern Pine Beetle

by
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Introduction

Figure 1.—Stands that are highly resistant to SPB attack should be a primary objective of management.

Much of today's southern pine forest resulted from natural seeding and planting on abandoned agricultural lands from 1930 through 1950. Young stands grew rapidly with little or no tending. Insect problems developed and intensified as stands became crowded and vigor declined. Silviculture offers the most promising and long-lasting means of reversing this trend (fig. 1). This handbook describes the characteristics of stands that are highly susceptible to southern pine beetle (SPB) attack and recommends cultural treatments that land managers and owners might consider to reduce losses from this pest.

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Identifying Susceptible Stands

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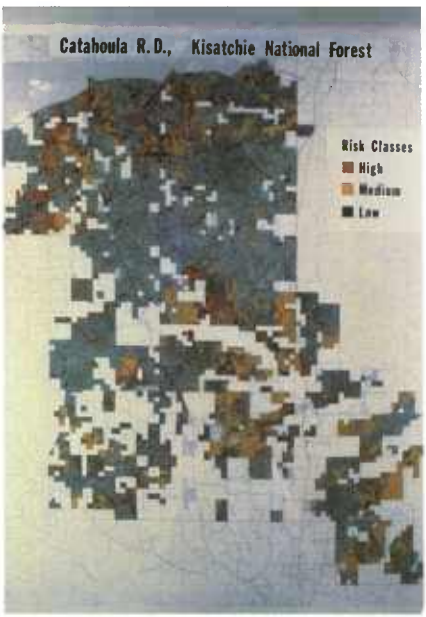


Figure 2.—Hazard ratings indicate where SPB infestations are most likely to occur.

The SPB occurs across all geographic regions of the South. Site conditions, tree species, and size classes associated with SPB attacks differ somewhat between the Coastal Plain, the Piedmont, and the Southern Appalachian Mountains (table 1). But slow radial growth and dense stocking are common measures of high-hazard stands.

Several rating systems have been developed that provide an evaluation of potential risk (*see* Selected References). Hazard ratings indicate where beetle outbreaks are most likely to occur (fig. 2), and, if they do, where losses and beetle activity are likely to be greatest. Testing and implementation of the ranking sys tems have been limited to stand, site, and insect conditions associated with selected areas in the geographic subregions, however.

Rating systems can also be used to evaluate the effectiveness of silvicultural treatments in reducing susceptibility of stands to beetle attack. Information regarding hazard-rating systems for specific localities can be obtained from State forestry agencies.

The Southern Coastal Plain

Natural stands susceptible to SPB attack in the Coastal Plain are characterized by high stand densities, a large proportion of pine sawtimber, and declining radial growth. Outbreaks occur most frequently in stands located on poorly drained soils and low-lying areas. Trees on dry or droughty soils are less commonly attacked. Rating systems have been developed for east Texas; the Kisatchie National Forest in Louisiana; corporate timberland in Texas, Louisiana, and Mississippi; and forests in south Arkansas.

The Piedmont

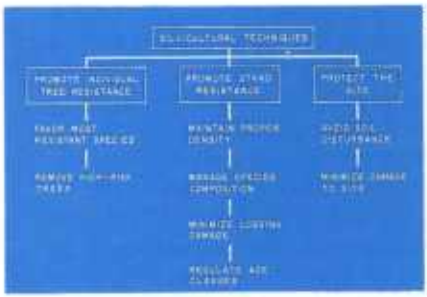
Natural stands susceptible to endemic SPB attack in the Piedmont are well-stocked pine stands with a large percentage of the host component in shortleaf pine, slow radial growth during the last 10 years, and a high clay content in surface and subsurface soils. Two systems have been developed for ranking the susceptibility of natural stands to SPB attack in the upper Piedmont of Georgia. The first is a predictive equation that includes variables easily measured or often contained in existing inventories; the second is a system designed for use in the field by service foresters.

Table 1.—*Characteristics of stands susceptible to SPB attack.*

Southern Coastal Plain	Piedmont	Southern Appalachians
Densely stocked stands	Well-stocked stands	Densely stocked natural stands
Large proportion of sawtimber	Small sawtimber	Large proportion of overmature sawtimber
Declining radial growth	Slow radial growth during last 10 years	Slow radial growth
Poorly drained soils and low-lying areas	High percentage of clay in surface and subsurface soils	Dry, south-facing slopes
High percentage of shortleaf and/or loblolly pine in the stand	High percentage of shortleaf pine in the stand	High percentage of shortleaf and/or pitch pine in the stand

The Southern Appalachians

Studies in the mountains of Georgia, North Carolina, South Carolina, and Tennessee have shown that stands severely attacked by the southern pine beetle were densely stocked, slow growing, and had a large proportion of overmature pine sawtimber. Shortleaf pine and pitch pine were more susceptible to beetle attack than Virginia pine and eastern white pine. Systems are currently being developed to rank the susceptibility of natural stands in the mountains.



Cultural practices to maintain healthy stands and reduce the incidence and severity of SPB attacks are in harmony with most management goals. Natural stands and plantations can be equally susceptible to SPB attack when poorly managed; they can be equally resistant to the beetle when treated properly. Treatments are assigned according to management objectives and economic considerations.

The forester must understand host and site factors that influence stand growth and development before he can prescribe practices to reduce losses from bark beetles. "Standard" silvicultural recommendations do not apply to all situations. Each region, forest, and resource objective will require specific practices to maintain or increase the resistance of host trees to beetle attack. The following guidelines (fig. 3) may be helpful in developing prevention strategies. Obviously, high-hazard stands should get first attention.

Figure 3.—Silvicultural guidelines to reduce losses from the SPB.

Promote Individual Tree Resistance

Favor Most Resistant Species.—Some pine species are more resistant to SPB attack than others. Also, relative susceptibility of host types differs between geographic regions (table 2). Intermediate cuttings and reproduction methods should favor species that are best suited to the site and most resistant to SPB attack.

Remove High-Hazard Trees.—Every stand has some damaged or weakened trees that are highly susceptible to SPB attack. This damage can result from lightning, logging, ice, or other destructive agents (fig. 4). Injured trees may also attract the black turpentine beetle, and *Ips* species. Susceptibility is greatest immediately following damage and tends to decline with time. Salvage cutting

Figure 4.—Pines struck by lightning are attractive to bark beetles. (Photo courtesy of the South Carolina Commission of Forestry.)

Table 2.—*The susceptibility of pines to SPB attack for major geographic regions of the South.*

Levels of susceptibility	Geographic Region: Coastal Plain	Geographic Region: Piedmont	Geographic Region: Southern Appalachian
Most resistant	Slash Longleaf	Virginia Loblolly	Virginia Eastern white
Most susceptible	Shortleaf Loblolly	Shortleaf	Shortleaf Pitch

to remove severely damaged trees should be completed as soon as possible.

Extreme drought or flooding increases the probability of SPB attack in stands. There is little the forester can do to prevent these conditions, but losses may be minimized through frequent aerial detection flights over high-hazard stands during periods of extreme climatic stress. Infestations that do occur in these areas should be treated using approved control procedures.[2]

[2]For a discussion of SPB control tactics, *see* "Direct Control Methods for the Southern Pine Beetle," by Swain and Remion (Agriculture Handbook 575).

Regulate Stocking.—High-hazard stands are characterized by dense stocking and slow radial growth (fig. 5). Thinning will stimulate growth and vigor in young stands and reduce the likelihood of future losses from the SPB (fig. 6). Low thinning or "thinning from below" is recommended to reduce competition and remove slow-growing trees, which are most subject to SPB attack (fig. 7). The poorer crown classes—suppressed and intermediate trees—are cut first. Dominant and codominant trees with large live crown ratios and desirable phenotypic traits should be favored as crop trees. They are most likely to respond to thinning and to provide the greatest number of silvicultural options in the management of residual stands.

Thinning schedules depend on the close relationships between site quality, stand age, stocking, live crown ratio of individual trees, and growth rate. Root and crown competition among individual trees develop at ages 10 to 15 years on most sites. Crowding can occur earlier than age 10 on better-quality sites that contain a large number of trees. Initial thinning should be scheduled before live crown ratios drop to 40 percent. Delay will reduce stand vigor to levels unfavorable for growth but attractive to the SPB.

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Figure 5.—Slow radial growth is a common measure of high-risk stands.

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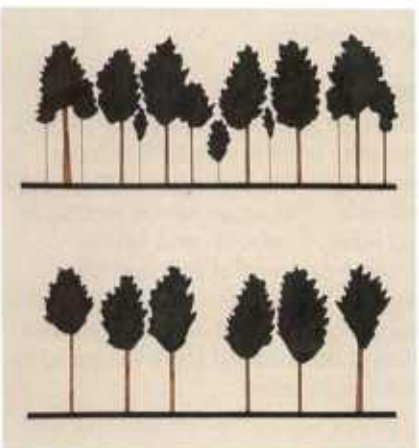

Figure 6.—Thinning promotes the rapid growth and vigor of young stands. (Photo courtesy of the Texas Forest Service.)

Figure 7.—Low thinning will remove small, slow-growing trees that are susceptible to SPB attack (top). Healthy dominant and codominant trees should be favored as crop trees (bottom).

Degree of thinning is determined by the intensity of management, the kind of product desired, available markets, and natural conditions particular to each location. Depending on site quality, basal areas of 80 to 100 ft^2/acre are recommended to reduce the potential for SPB attacks. The risk of beetle attack in most instances will increase considerably when stocking levels exceed 100 ft^2/acre. Wide spacings distribute growth on fewer stems, resulting in the production of small sawlogs by age 35 to 40 years on good sites. Close spacings are recommended for high yields of wood fiber. Thinnings should be scheduled as needed to maintain desired stocking levels and stand vigor.

Mix Pine and Hardwood.—The SPB prefers pure pine stands. A mixture of pine and hardwood species reduces the potential for spot incidence and growth. Stands composed of pines and hardwoods may be suited to owners of nonindustrial woodlands managing for products other than or in addition to timber; such stands often support diverse wildlife populations, are esthetically pleasing, and contribute to soil improvement. However, intensive forest management is required to obtain and maintain the mixed species composition best suited for a given location.

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Minimize Logging Damage.—Damage from recent logging (within the past year) favors SPB infestations. Careless cutting, skidding, and hauling often cause severe mechanical injury to above- and below-ground portions of residual trees (fig. 8). Moderately to severely damaged trees are high-hazard trees and should be removed from the stand as soon as possible.

Figure 8.—Trees severely damaged by logging equipment should be removed from the stand.

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Use of small harvesting equipment and removal of short roundwood are recommended for intermediate cuttings. Heavy equipment and tree-length logging generally increase the amount of damage to residual trees. Equipment operators and ground crews should be trained to minimize damage to residual trees and thus reduce the likelihood of bark beetle attacks.

Regenerate Overmature Stands.— Susceptibility of trees to SPB attack increases with age. Mature and overmature trees usually have slower radial growth, flat-topped crowns, and sparse foliage. These trees seldom respond to intermediate cuttings and should be replaced with the most resistant host species or a species mix suited to the area (fig. 9).

Many overmature pine stands throughout the South are being intentionally preserved for ecological, wildlife, or esthetic reasons. These stands are extremely susceptible to attack and should be monitored regularly to detect the buildup of SPB populations early, when remedial action can save the pine component.

Figure 9.—Stands should be regenerated with pine most resistant to SPB attack. (Photo courtesy of the Mississippi Forestry Association.)

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Figure 10.—Soils that contain a high percentage of micaceous red clays characterize high-hazard sites in the Piedmont. These problem soils require careful tending.

Southern pine beetle infestations are associated with soil and site conditions in the Piedmont and Coastal Plain. High-hazard sites in the Piedmont are characterized by heavy red clays (fig. 11). These sites have a high erosion potential, limit the infiltration and percolation of water, and restrict root development. Such problem soils require careful tending to prevent further deterioration of the site. Intensive site preparation (e.g., root raking, disking) and cultivation with heavy equipment are recommended only where soils and slopes are suited for these practices. The application of intensive site preparation methods should be avoided on slopes greater than 10 percent. Burning and the use of suitable herbicides appear to be preferable to intensive mechanical site preparation in regenerating these areas. Abuse of already fragile sites in the Piedmont will contribute to future insect and disease problems.

Infestations in the Coastal Plain occur more frequently on wet and waterlogged sites than on well-drained soils. Trees on poorly drained sites are often deficient in mycorrhizal roots and are, therefore, subject to severe physiological stress during periods of drought. Drainage systems designed to remove surplus water from low-lying areas will curtail the damage from root diseases and stem the decline of host pines. Logging damage in low-lying areas with fine-textured soils can be avoided by diverting operations to sandy soils during wet periods and using harvesting equipment of low bearing pressure.

Minimize Disease and Competition Problems

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Stands should be managed to prevent or reduce losses from all disease and insect pests. Studies have shown a close association between annosum root rot and SPB attack (fig. 11). Precautions should be taken to reduce the danger of annosum infection. Intermediate cuttings to remove high-hazard SPB trees or to promote stand vigor should be scheduled during summer, when fewer annosum spores are produced and high temperatures kill those that are produced. Treating stumps with borax or *Peniophora* spores also reduces the incidence and spread of infection.

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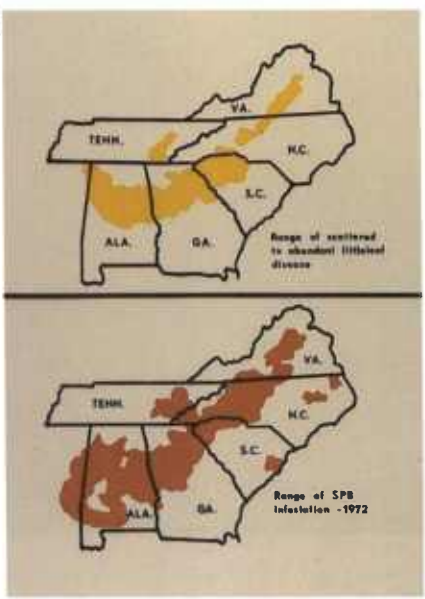

Stands with littleleaf disease are generally high-hazard SPB areas (fig. 13). "Locus" trees—those first attacked and preferred by the SPB—are often dominant and codominant shortleaf pine trees with large live crown ratios and root systems in incipient stages of decline. Trees in advanced stages of littleleaf decline are seldom killed by the SPB. Sanitation cuttings are recommended to utilize both diseased and SPB-attacked trees. Stands should be regenerated before they reach advanced stages of decline, usually between the ages of 30 and 40. Loblolly pine is not as susceptible to littleleaf disease as shortleaf pine and should be favored when regenerating stands.

Figure 11.—Annosum root rot is closely associated with SPB attack.

Figure 12.—Littleleaf sites are high-hazard SPB areas. In the Southeast, SPB infestations (1972) were closely associated with the range of severe littleleaf disease.

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Figure 13.—Prescribed burning can be used to reduce competition in high-hazard stands.

Trees heavily infested with fusiform rust galls should be salvaged. Diseased stems are subject to breakage by wind and ice, and may be infection courts for numerous insect and disease organisms. Sanitation cuttings will lower the potential for attack and spread of insect pests and provide cash returns from salvaged materials.

Prescribed burning should be considered as a pest management practice. Burning can be used to eliminate suppressed high-hazard trees from overstocked stands (fig. 13). Stand vigor will be further increased by reducing competition from understory hardwoods and vegetation. Prescribed burning before and after thinning also reduces severity of annosum root rot in the South. Controlled use of fire does not increase SPB activity: it can be a useful tool in reducing losses from pests.

Stands and forests that are highly resistant to SPB attack should be equally resistant to attack by other bark beetles. Maintaining healthy stands is the key to integrated pest management (IPM).

Planning and Application.—The risk of SPB attack and rapid spot growth is lowest when insect populations are down. This is the best time to plan and implement silvicultural treatments related to IPM. Mill quotas are not filled with salvage wood, and operators are available to conduct intermediate cuttings. The "reservoir" of SPB-infested and high-hazard trees is removed, and more growing space is provided for residual trees. High-hazard stands can be identified and treated to reduce their susceptibility to beetle attack and the potential for spot growth in a future outbreak. Low-hazard stands can be tended to maintain vigor and rapid growth. Stands and forests that are highly resistant to SPB attack should be a primary objective of management. Prevention silviculture offers the most practical and long-lasting means of achieving this goal. In short, good forest management is good pest management.

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